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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/822,345	04/12/2004	Meng Tao	124263-1019	3116

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EXAMINER

RODGERS, COLLEEN E

ART UNIT	PAPER NUMBER
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2813

DATE MAILED: 07/11/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/822,345	TAO ET AL.	
	Examiner	Art Unit	
	Colleen E. Rodgers	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 10 May 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-31 is/are pending in the application.
- 4a) Of the above claim(s) 28-31 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-27 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 12 April 2004 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| Paper No(s)/Mail Date <u>9/13/04 & 11/21/05</u> . | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of Group II, and furthermore Species II-A, in the reply filed on 10 May 2006 is acknowledged. The traversal is on the ground(s) that a search of art for Group II would necessarily include Group I; and also that Species II-B and II-C are not patentably distinct from Species II-A. The first argument with respect to Groups I and II is not found persuasive because the separate classifications of Groups I and II would require separate searches. However, the second argument with respect to Species II-A, II-B and II-C is found persuasive, and therefore claims 1-27 will be examined on the merits.

The requirement between Groups I and II is still deemed proper and is therefore made FINAL.

Information Disclosure Statement

2. The Information Disclosure Statements dated 13 September 2004 and 21 November 2005 have been considered. However, on the IDS dated 13 September 2004, a spelling error ("dimmer" instead of --dimer--) has been noted thereon.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 4 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the

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invention. Specifically, claim 4 recites the limitation "the oxygen-containing ambient" in line 1.

There is insufficient antecedent basis for this limitation in the claim.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-9, 11-19 and 21-26 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Herbots et al** (USPN 6,613,677) in view of **Ahn et al** (USPN 6,921,702).

Regarding claim 1, **Herbots et al** disclose a method of improving the interface between a dielectric and a semiconductor material comprising the steps of:

preparing a passivated semiconductor surface using a valence-mending agent [see col. 9, lines 1-4]; and

performing an oxidation step to form a dielectric on the surface.

Herbots et al do not disclose wherein the oxidation is accomplished by depositing a precursor to a dielectric on the valence-mended semiconductor surface and oxidizing the precursor to a dielectric. **Ahn et al** disclose a method of depositing a precursor to a dielectric on a substrate and oxidizing [see, for example, col. 8, lines 57-67]. It would have been obvious to one of ordinary skill in the art at the time of invention to use the metal-precursor oxidation method as taught by **Ahn et al** in the method of **Herbots et al** because **Herbots et al** teach that "all known oxidation

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processes are expected to satisfactorily perform this final oxidation step” [see **Herbots et al**, col. 9, lines 44-47].

Regarding claim 2, the prior art of **Herbots et al** and **Ahn et al** disclose the method of claim 1 as described above. Furthermore, **Ahn et al** disclose wherein the precursor to a dielectric is hafnium or zirconium, both of whose oxides are a dielectric [see col. 8, lines 57-67; col. 9, lines 1-12].

Regarding claims 3 and 4, the prior art of **Herbots et al** and **Ahn et al** disclose the method of claim 1 as described above. Furthermore, **Ahn et al** disclose wherein oxidizing is in an oxygen-containing ambient, specifically water vapor and nitrogen [see col. 8, line 57 to col. 9, line 12].

Regarding claim 5, the prior art of **Herbots et al** and **Ahn et al** disclose the method of claim 1 as described above. Furthermore, both **Herbots et al** and **Ahn et al** disclose wherein the substrate may be silicon, germanium or silicon-germanium [see **Herbots et al**, col. 4, lines 15-20 and **Ahn et al**, col. 2, lines 52-55].

Regarding claim 6, the prior art of **Herbots et al** and **Ahn et al** disclose the method of claim 1 as described above. Furthermore, **Ahn et al** disclose wherein deposition may be by thermal evaporation [see col. 9, lines 1-12].

Regarding claim 7, the prior art of **Herbots et al** and **Ahn et al** disclose the method of claim 1 as described above. Neither **Herbots et al** nor **Ahn et al** disclose the time for which oxidizing occurs. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of

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the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the oxidation time provides unexpected results in the dielectric produced. One of ordinary skill in the art would be motivated to optimize the oxidation time to provide for processing limitations.

Regarding claim 8, the prior art of **Herbots et al** and **Ahn et al** disclose the method of claim 1 as described above. Neither **Herbots et al** nor **Ahn et al** disclose the pressure at which oxidizing occurs. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the oxidation pressure provides unexpected results in the dielectric produced. One of ordinary skill in the art would be motivated to optimize the oxidation pressure to provide for processing limitations.

Regarding claim 9, the prior art of **Herbots et al** and **Ahn et al** disclose the method of claim 1 as described above. Furthermore, **Herbots et al** disclose wherein the passivating agent is hydrogen [see col. 9, lines 1-4].

Regarding claim 11, the prior art of **Herbots et al** and **Ahn et al** disclose the method of claim 1 as described above. Neither **Herbots et al** nor **Ahn et al** disclose the temperature at which oxidizing occurs. These claims are *prima facie* obvious without a showing that the claimed ranges achieve unexpected results relative to the prior art range. *In re Woodruff*, 16 USPQ2d 1935, 1937 (Fed. Cir. 1990). See also *In re Huang*, 40 USPQ2d 1685, 1688 (Fed. Cir. 1996) (claimed ranges of a result effective variable, which do not overlap the prior art ranges, are unpatentable unless they produce a new and unexpected result which is different in kind and not merely in degree from the results of the prior art). See also *In re Boesch*, 205 USPQ 215 (CCPA) (discovery of optimum value of result effective variable in known process is ordinarily within skill of art) and *In re Aller*, 105 USPQ 233 (CCPA 1955) (selection of optimum ranges within prior art in general conditions is obvious). In this case, there exists no evidence of record that the oxidation temperature provides unexpected results in the dielectric produced. One of ordinary skill in the art would be motivated to optimize the oxidation temperature to provide for processing limitations.

Regarding claim 12, the prior art of **Herbots et al** and **Ahn et al** disclose the method of claim 1 as described above. Furthermore, **Herbots et al** disclose wherein depositing the valence-mended semiconductor surface is at room temperature [see col. 9, lines 37-41].

Regarding claim 13, the prior art of **Herbots et al** and **Ahn et al** disclose the method of claim 1 as described above. Neither **Herbots et al** nor **Ahn et al** specifically discloses that the method significantly improves the capacitance-voltage characteristics of the interface between the dielectric and the valence-mended semiconductor surface. However, as this is merely a result of the method, it is considered to be anticipated by the above-cited art.

Regarding claims 14-19 and 21-26, the prior art of **Herbots et al** and **Ahn et al** disclose the methods as claimed. In the Remarks dated 10 May 2006, Applicant states that, "Species II-A, II-B

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and II-C are not patentably distinct because each are obvious variants that described a portion of the claimed invention.” This is considered to be an admission that claims 14-19 and 21-26 are obvious over claims 1-13, and therefore rejected as explained above with reference to the generic claims.

7. Claims 10, 20 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Herbots et al** (USPN 6,613,677) and **Ahn et al** (USPN 6,921,702) and further in view of the article by **Boland**, “Structure of the H-Saturated Si(100) Surface,” *Phys. Rev. Lett.* **65**(26), 1990, pp. 3325-3328.

Regarding claim 10, the prior art of **Herbots et al** and **Ahn et al** disclose the method of claim 1 as described above. While **Herbots et al** disclose that the passivation layer of hydrogen is “ultra thin,” which is defined as 40 Å or less, it does not specifically disclose that it is one atomic layer thick. However, **Boland** discloses that the coverage for hydrogen on silicon, for instance, is 1 monolayer. It would have been obvious to one of ordinary skill in the art at the time of invention to deposit one monolayer of the valence-mending agent because **Boland** teaches that it is well-established in the art [see page 3325, col. 1, lines 1-14].

Regarding claims 20 and 27, the prior art of **Herbots et al**, **Ahn et al** and **Boland** disclose the methods as claimed. In the Remarks dated 10 May 2006, Applicant states that, “Species II-A, II-B and II-C are not patentably distinct because each are obvious variants that described a portion of the claimed invention.” This is considered to be an admission that claims 20 and 27 are obvious over claim 10, and therefore rejected as explained above with reference to the generic claim.

Conclusion


8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. **Kirk et al** (USPN 6,419,742); **Nagamine et al** (USPN 6,287,988).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Colleen E. Rodgers whose telephone number is (571) 272-8603. The examiner can normally be reached on Monday through Friday, 9:00 AM to 6:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead can be reached on (571) 272-1702. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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